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Wind and its Relation to Forest Fires

by

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From the standpoint of forest fires the air movement functions as a drying, fanning and carrying agency. In considering air movement it is important to bring out the direction, force and variations which may exist for different parts of the District, for different seasons, months, time of day and under special conditions of weather elevation or topography. Table 1 gives average movement in miles per hour for the weather bureau control stations within or near to District One in miles per hour.

Table 1

Wind Movement District One - Average Miles per Hour.

Station	Record	April	May	June	July	Aug.	Sept.	Av.
Spokane	25 yrs. 1909 to	6.9	6.7	6.8	5.9	5.3	5.4	6.2
Lewistown	1919	4.9	4.2	4.6	4.5	3.7	3.5	4.2
Priest River	SW slope 5 yrs. to 1916	3.4	3.3	3.2	2.9	2.7	2.6	3.0
Kalispell	1909-19	5.4	5.4	4.4	4.9	4.4	4.2	4.8
Helena	19 yrs.	5.6	6.8	7.2	7.7	7.8	7.4	7.1
Havre	1911-19	7.5	8.9	7.8	6.9	6.2	6.7	7.3
Miles City	1909-19	7.1	6.8	6.3	5.7	5.1	5.2	6.0
Yellowstone Park	1909-19	8.0	8.2	7.6	6.5	6.7	7.2	7.4

It will be seen that during the months of July and August the movement is greater at Helena and Havre than at the other stations. The prevailing wind direction in summer over Washington and northern Idaho is from southwest and to the east of the Continental Divide it is from the northwest and southeast. Considerable variation and deflection takes place according to topography for the wind follows pronounced canyons, and takes advantage of gaps in a divide. The Joki fire on the Coeur d'Alene Forest 1919 followed the canyon of the Coeur d'Alene River. Complete maps showing the prevailing local wind direction for different parts of the District are not available, but each man knows fairly well the conditions for his own territory.

The velocity, and drying as well as the carrying effect of the wind will vary according to the height and direction of the mountain ridges. In the Clearwater drainage the air movement is in many cases parallel with the ridges so that the wind gets a freer sweep, whereas in the Panhandle of Idaho the ridges lie transversely to the prevailing wind and thereby break its force. The valleys are therefore less exposed and high winds there than if the ridges had an east and west trend.

Air movement on the peaks and lookouts has been shown to be considerably greater than at lower points. These are given in Table II.

TABLE II.

Air Movement on LookoutsSummer 1919

(Miles per hour, per day)

STATION ELEVATION FOREST	<u>JUNE</u>		<u>JULY</u>		<u>AUGUST</u>		<u>SEPTEMBER</u>		<u>RECORD</u>
	AVERAGE	MAXIMUM°	AVERAGE	MAXIMUM°	AVERAGE	MAXIMUM°	AVERAGE	MAXIMUM°	MISSING DATES
Sunset 6,424									
Coeur d'Alene	8.8	12.1	9.6	15.9	10.2	14.9	12.6	21.5	June 1-15 Sept. 16-30
Mt. Silcox 6,840									
Cabinet			11.7	21.2	12.5	24.7			None
Coolwater 6,930									& 26 June 1-16
Selway	8.9	19.9	8.2	12.7	8.1	10.2	9.9	16.2	Sept. 21-30
Monumental Buttes 6,979									July 1-7 Sept. 18-30
St. Joe			13.0	28.6	15.0	29.6	15.5	27.5	16,17 July 1, 2,- Aug. 5-12
Priest River 6,000									Sept. 20-30
Kaniksu			9.5	16.1	8.9	14.3	10.6	22.4	July 1-12 Sept. 20-30
Mount Silcox Cabinet 1917			13.0	13.8	11.5	23.1	12.4	21.6	Sept. 20-30
Mount Silcox Cabinet 1918	14.7	20.2	12.7	26.7	?	20.0	14.3	31.0	June 1-17 Sept. 24-30

Note:-These do not represent the absolute maximum velocities that may occur.

°These figures represent the highest velocity recorded for any one day.

Priest River - W. Simmons Lookout men who took records: Monumental Buttes-Eugene Harpole

Sunset - Paul Wickward Mt. Silcox - Jefferson C. McKeel 1918

Coolwater - Gerald J. Gill -3- L. F. Rosenthal 1919

Comparative records which show how the wind varies for different parts of the day at high and low points are given in Table III.

TABLE III

Wind on the Lookout and in the Valley Priest

River Experiment Station, 1917.

Average Miles per Hour by Months.

Time of Day	July	August	September
	Mtn. Valley	Mtn. Valley	Mtn. Valley
5 PM-8AM	10.9 0.9	8.4 0.8	8.1 0.8
8 AM-1PM	9.9 3.6	7.9 3.1	3.0 2.5
1 PM-5PM	11.4 3.9	9.7 3.2	7.3 2.3

Table III brings out that the air in the valley is almost still at night and that on the mountain there is almost as much movement at night as during the day. This fact, when considered in connection with the lower relative humidity which was shown to prevail on the mountain at night, (Applied Forestry Notes, February), helps to explain why fires burn better at night at higher elevations than in the valley.

It is of considerable interest to note how the rate differs for different aspects. This is brought out in the records taken from 1911 to 1916 at Priest River Experiment Station in northern Idaho.

TABLE IV.

Greatest Air Movement for any One Month, Miles per Hour.

Month or Season	NE Slope	SW Slope	Flat
May	2.9	8.7	5.7
June	2.1	6.8	3.3
July	1.9	7.9	3.7
August	1.9	7.6	3.6
September	1.9	8.6	3.9

The hourly wind records which have been compiled at the Experiment Station show that the highest velocities are reached at 4 PM and the lowest from 4 to 5 AM during the summer months. The time of the highest movement coincides with the

time of the highest air temperature and the lowest relative humidity.

Chinook winds reduce the layer of snow throughout the winter and frequently cause early disappearance of snow and this may bring on the fire season at an earlier date in the mountains than would otherwise be the case.

We have in mountainous country characteristic monsoons, sometimes referred to as air drainage, the air moves up the valley during the day and down the valley at night. In the evening when the two currents meet toward the upper part of the valley it causes a bank of smoke about the time of sunset which interferes with the visibility to a marked degree. The following morning the air current from above has generally cleared the entire watershed of smoke. The downward movement begins earlier in the afternoon on the shaded than the sunny side of the mountain.

How did the wind act on the lookouts on or about August 19, 1919 at the time of the holocausts on the Clearwater and the Coeur d'Alene Forests? Not so very bad. Here are the records in miles per hour for the 18th and 19th.

Lookouts	August	
	18th	19th
Sunset	8.8	---
Monumental		
Buttes	18.3	6.8
Priest River	9.6	11.8
Coolwater	5.6	6.0
Mt. Silcox	9.0	---

Mr. G. A. Beals in the U. S. Monthly Weather Review, February 1914, points out that no unusual conditions which would cause extraordinary winds attended or preceded the worst fire on record on the Columbia Forest in the Cascades 1902. On the contrary the atmosphere had been comparatively still for three weeks previously. But - and hereby hangs a tale - the wind shifted to blow from the northeast the day before the fire. It then blew from the dry country lying between the Cascades and the Bitterroots. And, are we not exposed to the wind from this dry region most of the time in northern Idaho in summer?

The unusually high winds which accompany the large forest fires appear to be caused and set in motion by the flames themselves. Evidently the ascending currents of heated air and smoke make an opening through the upper, colder stratum of the air, not much unlike a tall chimney, and the strong surface

winds which uproot trees are caused by the inrush of air to fill the vacant space left by the upward draft.

Nobody can foretell the speed or the force of this tornado-like sweep. At the time of the Hinckley fire one wagon which weighed a thousand pounds was lifted up and carried across a railroad track. Needless to say that it would be impossible for anybody to maintain a standing position. In this connection it is interesting to read again Mr. Girard's vivid description of what he experienced on the Clearwater Forest August 19, 1919, in the Weekly Bulletin of the Washington Office, September 22, 1919.

J. A. I.